

AMENDMENTS TO THE CLAIMS

1 (currently amended) A fluid discharge method for intermittently discharging fluid, the fluid discharge method comprising: by making
feeding the fluid fed from a fluid supply device to a gap defined between
opposed relatively moving surfaces of two members while keeping the two members
moving relative to each other along a direction of the gap, and by
utilizing a pressure change caused by changing the gap so that the fluid is
intermittently discharged through a discharge port communicating with the gap,
wherein the opposed relatively moving surfaces of the two members are
provided in n sets, where n is an integer not less than 1, and
wherein given a total volume V_1 (mm^3) of the n sets of the opposed
relatively moving surfaces, a total volume V_2 (mm^3) of flow passages that connect the n
sets of the opposed relatively moving surfaces and the fluid supply device to each other,
an absolute value X_{st} (mm) of a stroke of the n sets of the opposed relatively moving
surfaces that move relative to each other, a time T_{st} (sec) required for the n sets of the
opposed relatively moving surfaces to move by the stroke X_{st} , a fluid internal resistance
 R_s (kgsec/mm^5) of the fluid supply device, a fluid resistance R_n (kgsec/mm^5) of the
discharge port, a modulus of elasticity of volume K (kg/mm^2) of the fluid, an effective
area S_p (mm^2) of the opposed relatively moving surfaces, and a sum P_{s0} (kg/mm^2) of a
maximum pressure of the fluid supply device and an auxiliary pressure for introducing
the fluid into the fluid supply device, and
wherein if it is defined that $V_s = V_1 + V_2$ and that a time constant T and an
intermittent interception control parameter II_c are

$$T = \frac{R_s R_n}{R_n + n R_s} \frac{V_s}{K}$$

and

$$II_c = \frac{R_s S_p X_{st} (1 - e^{-\frac{T_{st}}{T}})}{2 P_{s0} T_{st}}$$

respectively, then it holds that $II_c > 1$.

2 (currently amended) The fluid discharge method according to Claim 1, wherein

$$P_{s0} + \frac{S_p X_{st} K}{2 V_s} > 0.2$$

3 (currently amended) A fluid discharge method for continuously discharging fluid, the fluid discharge method comprising: ~~by making~~

feeding the fluid ~~fed~~ from a fluid supply device to a gap defined between opposed relatively moving surfaces of two members that move relative to each other along a direction of the gap so that the fluid is continuously discharged through a discharge port communicating with the gap,

wherein the opposed relatively moving surfaces of the two members are provided in n sets, where n is an integer not less than 1, and

wherein given a total volume V_1 (mm^3) of the n sets of the opposed relatively moving surfaces, a total volume V_2 (mm^3) of flow passages that connect the n sets of the opposed relatively moving surfaces and the fluid supply device to each other, an absolute value X_{st} (mm) of a stroke of the n sets of the opposed relatively moving surfaces that move relative to each other, a time T_{st} (sec) required for the n sets of the opposed relatively moving surfaces to move by the stroke X_{st} , a fluid internal resistance R_s (kgsec/mm^5) of the fluid supply device, a fluid resistance R_n (kgsec/mm^5) of the discharge port, a modulus of elasticity of volume K (kg/mm^2) of the fluid, an effective area S_p (mm^2) of the opposed relatively moving surfaces, and a sum P_{s0} (kg/mm^2) of a maximum pressure and an auxiliary pressure of the fluid supply device,

wherein if it is defined that $V_s = V_1 + V_2$ and that a time constant T and a continuous interception control parameter CI_c are

$$T = \frac{R_s R_n}{R_n + n R_s} \frac{V_s}{K}$$

and

$$CI_c = \frac{R_s S_p X_{st} (1 - e^{-\frac{T_{st}}{T}})}{P_{s0} T_{st}}$$

respectively, then it holds that $CI_c > 1$.

4 (currently amended) A fluid discharge method for continuously or intermittently discharging fluid, the fluid discharge method comprising by making

feeding the fluid ~~fed~~ from a fluid supply device to a gap defined between opposed relatively moving surfaces of two members that move relative to each other along a direction of the gap so that the fluid is continuously or intermittently discharged through a discharge port communicating with the gap,

wherein the two members that move relative to each other in the gap direction are provided in n sets, where n is an integer not less than 1, and

wherein given a total volume V_1 (mm^3) of the n sets of the opposed relatively moving surfaces, a total volume V_2 (mm^3) of flow passages that connect the n sets of the opposed relatively moving surfaces and the fluid supply device to each other, a fluid internal resistance R_s (kgsec/mm^5) of the fluid supply device, a fluid resistance R_n (kgsec/mm^5) of the discharge port, a fluid resistance R_p (kgsec/mm^5) of radial flow passages that connect the discharge port and outer peripheries of the opposed relatively moving surfaces to each other, and a modulus of elasticity of volume K (kg/mm^2) of the fluid, and

wherein if it is defined that $V_s = V_1 + V_2$ and that a time constant T is

$$T = \frac{R_s R_n}{R_n + R_p + n R_s} \frac{V_s}{K}$$

then it holds that $T \leq 30$ msec.

5 (currently amended) The fluid discharge method according to Claim 1,
 wherein in a multi-head for ~~feeding~~making the fluid fed from the single fluid supply device to the ~~gaps~~ between the plural-opposed relatively moving surfaces in which $n \geq 3$, the ~~mutually generally parallel~~ flow passages are formed generally mutually parallel and so as to lead from a common flow passage arranged on a way between the fluid supply device and the plural-opposed relatively moving surfaces so as to communicate with the fluid supply device on an upstreamits upper stream side and communicate with the individual opposed relatively moving surfaces on a downstreamits lower stream side in such a manner that fluid resistances of the individual flow passages are equal to one another.

6 (currently amended) The fluid discharge method according to Claim 1,
 wherein in a multi-head for ~~feeding~~making the fluid fed from the single fluid supply device to the ~~gaps~~ between the plural-opposed relatively moving surfaces in which $n \geq 3$, at least one of the flow passages ~~is~~are formed in a bent configuration so that fluid resistances of the individual flow passages are equal to one another.

7 (currently amended) The fluid discharge method according to Claim 1,
 wherein an axial drive device for relatively moving the opposed relatively moving surfaces is implemented by using an electro-magnetostriction element, and
wherein $T \leq 30$ msec.

8 (currently amended) The fluid discharge method according to Claim 7,
 wherein the ~~discharge~~ fluid is intermittently flowedflow and discharged onto a substrate, which is a discharge target, with a cycle period $T_p = 0.1$ to 30 msec in a state that viscosity μ of the of the discharge fluid is $\mu > 100$ mPa·s, diameter ϕ of

powder material contained in the discharge fluid is $\phi_d < 50 \mu\text{m}$, flow passages between the relatively moving members keep mechanically completely contactless during discharge process, and that a gap H between a discharge nozzle serving as the discharge port and the discharge-target substrate is $H \geq 0.5 \text{ mm}$.

9 (currently amended) The fluid discharge method according to Claim 1,
wherein a continuous flow supplied from the fluid supply device is converted into an intermittent flow by utilizing the pressure change due to a change in the gap defined between the opposed relatively moving surfaces, and
wherein an intermittent discharge amount per dot is controlled by setting of pressure and flow-rate characteristics of the fluid supply device.

10 (previously presented) The fluid discharge method according to Claim 9,
wherein the fluid supply device is a pump which allows the flow rate to be changed by its rotating speed.

11 (previously presented) The fluid discharge method according to Claim 10,
wherein the fluid supply device is a thread groove pump.

12 (currently amended) The fluid discharge method according to Claim 1,
wherein the flow rate for each intermittent discharge of fluid ~~one shot~~ is set by changing at the rotating speed of the fluid supply device.

13 (currently amended) The fluid discharge method according to Claim 1,
wherein an ~~the~~ axial drive device for relatively moving the opposed relatively moving surfaces is a resonant oscillator.

14 (currently amended) The fluid discharge method according to Claim 1,
wherein while a discharge nozzle serving as the discharge port and a discharge-target substrate are kept moving relative to each other, the fluid in ~~of~~ an equal

discharge amount per dot is intermittently discharged periodically by taking advantage of the discharge-target surface's geometrical symmetry.

15 (currently amended) The fluid discharge method according to Claim 1,
wherein ~~a~~the discharge-target surface is a display panel.

16 (currently amended) The fluid discharge method according to Claim 1, the method being a method for forming a fluorescent material layer of a plasma display panel,
wherein while a dispenser having a discharge nozzle serving as the discharge port is kept moving relative to a discharge-target substrate on which independent ribs surrounded by barrier ribs are geometrically symmetrically formed so as to create independent cells, fluorescent material paste as the fluid is intermittently discharged from the discharge nozzle so that the fluorescent material paste is discharged into interiors of the independent cells successively, whereby a fluorescent material layer is formed.

17 (currently amended) The fluid discharge method according to Claim 1,
wherein if a volume of a flow passage that connects the fluid supply device and one ~~of the n sets of the opposed piston forming the gap of the~~ relatively moving surfaces is V_{2S} , then it holds that $10 < V_{2S} < 80 \text{ mm}^3$.

18 (currently amended) The fluid discharge method according to Claim 1,
wherein if h_0 is a setting range of a minimum value or a mean value h_0 of the gap, and a setting range of h_0 over which a discharge amount per dot Q_s is largely dependent on~~affected by a size of the minimum value or mean value h_0 of the gap~~ is $0 < h_0 < h_x$, and if a setting range of h_0 over which the discharge amount per dot Q_s is approximately independent of~~equal even to changes in the gap~~ h_0 is $h_0 > h_x$, then the fluid is intermittently discharged with the gap set within a range of $h_0 > h_x$ and

wherein h_x is based on a value of an intersection point between an envelope of the discharge amount per dot Q_s curve against h_0 and a line defined by $Q_s = Q_{se}$, and Q_{se} is a convergent value of the discharge amount per dot.

19 (currently amended) The fluid discharge method according to Claim 18,
~~wherein h_x is an intersection point between an envelope of a discharge amount Q_s curve against h_0 in a region of $0 < h_0 < h_x$ and~~
wherein Q_{se} is a convergent value of the discharge amount per dot such that $Q_s = Q_{se}$ as $h_0 \rightarrow \infty$.

20 (currently amended) The fluid discharge method according to Claim 1,
wherein if a minimum value or mean value of the gap defined between the opposed relatively moving surfaces is h_0 , then $h_0 > 0.05$ mm.

21 (withdrawn) A fluid discharge apparatus comprising:
two members which have n sets of opposed relatively moving surfaces for moving relative to each other along a direction of a gap formed between the n sets of opposed relatively moving surfaces; and
a fluid supply device for feeding fluid via a suction port to between those n sets of opposed relatively moving surfaces, with a discharge port provided at any one of the relatively moving surfaces,
wherein n is an integer not less than 1, and wherein given a total volume V_1 (mm^3) between the n sets of opposed relatively moving surfaces, a total volume V_2 (mm^3) of flow passages that connect the gap between the n sets of relatively moving surfaces and the fluid supply device to each other, a fluid internal resistance R_s (kgsec/mm^5) of the fluid supply device, a fluid resistance R_n (kgsec/mm^5) of the discharge port, a fluid resistance R_p (kgsec/mm^5) of a radial flow passage that connects the discharge port and outer peripheries of the relatively moving surfaces to each other, and a modulus of elasticity of volume K (kg/mm^2) of the fluid, if it is defined that $V_s = V_1 + V_2$ and that a time constant T is

$$T = \frac{R_s R_n}{R_n + R_p + nR_s} \frac{V_s}{K},$$

then it holds that $T \leq 0.03$.

22 (withdrawn) A fluid discharge apparatus, comprising: an axial drive device for giving an axial-direction relative displacement to between a shaft and a housing, with a discharge chamber defined by a shaft end face and the housing; and a fluid supply device for supplying fluid to the discharge chamber, with a flow passage for communicating the discharge chamber and the fluid supply device with each other, and with a suction port formed in the fluid supply device, and with a discharge port for communicating the discharge chamber and outside with each other,

wherein an opening area of the flow passage formed between the shaft and the housing is changed by an axial-direction relative move of the shaft and the housing, and the opening area becomes smaller at a discharge end stage than that at a suction end stage.